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ABSTRACT

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Role Plays, Panel Discussions, and Case Studies: Project-based Learning in a Web-based Course

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Abstract

Project-based learning in Web courses presents challenges and opportunities that groups in conventional settings may not encounter. This study is based on five project-based learning activities that 17 graduate students in a Web-based educational telecommunications course developed and conducted over a semester. The activities were: discussions of learning in telecommunications environments; role plays about teaching via telecommunications; case studies about management via telecommunications; evaluations of designated Web sites; and panel discussions of critical telecommunications issues. We investigated two issues related to project-based learning activities in a Web-based course: characteristics of activities that enable students to meet learning objectives; and strategies that student facilitators and student participants use to prepare and conduct the activities. Characteristics of project-based learning activities were identified as environments that students perceived as authentic or meaningful, collaborative work and communication via telecommunications, and activities that provided students with opportunities for both knowledge enhancement and skill building. The strategies of the students-as-facilitators were related to planning and conducting the activity for the participants. The strategies of the students-as-participants were related to carrying out the activities specified by the facilitators.

The surge in Web-based and Web-supported courses has prompted course designers and instructors to identify appropriate ways to adapt traditional courses to a Web environment (Khan, 1997). The Web environment is constructivist, providing for collaborative learning and learner-centered activities. Active construction of meaning (Vygotsky, 1978) about experiences should take place through "experiential exercises followed by interpersonal interaction in small groups, and with facilitators to guide the group towards useful conclusions" (Romiszowski, 1997, p. 33). Project-based learning in Web courses presents challenges and opportunities that groups in conventional settings may not encounter.

Theoretical Framework

Constructivism is the worldview that recognizes learning as the process of constructing meaning about, or making sense of, our experiences. Learning constructively, particularly in the social constructivist paradigm (Vygotsky, 1978), requires an environment in which collaboration situated in authentic activities takes place. Collaborative learning, which is considered a key element of constructivism, is fostered through such "coherent, meaningful, and purposeful activities" (Brown, Collins, & Duguid, 1989, p. 34) that Romiszowski (1997) recommends: small-group discussions, simulation games, project-based work, and collaborative problem-solving activities. All of these activities can be used in Web-based courses.

Collaborative learning is an instructional method in which small groups of learners work together to accomplish shared goals (Slavin, 1994). In collaborative learning environments, teachers teach for the most part indirectly, by reorganizing students socially and designing appropriate tasks (Bruffee, 1993). When students are required to enter the culture of teaching, novices benefit from the expertise of fellow students, while experts strengthen their knowledge and skills through the act of sharing their expertise (Norton & Wiburg, 1998). This distributed expertise often occurs through "reciprocal teaching," which creates a community of learners who learn how to learn and in turn become "intelligent novices" who teach each other (Brown et al., 1993). Project-based learning is described as learners working collaboratively over an extended period of time to solve an authentic and challenging problem that results in an end product (Moursund, 1998).

Computer conferencing software provides a collaborative workspace that usually includes threaded discussions in icon-based conferences, collaborative document writing spaces, file attachments, private email, and real-time text-based chats. Researchers have reported on ways that computer conferencing can foster effective collaborative learning (Davie & Wells, 1991; Harasim, Hiltz, Teles, & Turoff, 1995) by "examin[ing] ideas in a social context of different perspectives and develop[ing] collective ways to understand issues" (Riel, 1998, p. xix) and by building online learning communities (Murphy, Mahoney, & Harvell, 2000; Palloff & Pratt, 1999). Having multiple participants in a computer conference contributes to individuals' social constructions of meaning, their abilities to relate new knowledge structures to those they already possess, and their abilities to explore and create meaning (Garrison, 1993). Collaborative learning and computer conferencing are reciprocally related: while computer conferencing depends on the ability and willingness of participants to collaborate, collaborative learning is enabled by computer conferencing (Cifuentes, Murphy, Segur, & Kodali, 1997). Romiszowski and Mason (1996) posited that computer-mediated communication provides for two opposing paradigms: instructional, or traditional education, and conversational education, which is typical of collaborative learning environments. This conversational style is evident in computer conferencing environments "that are more authentic, situated, interactive, project-oriented, interdisciplinary, learner-centered" (Berge, 1997, p. 13). Such conversation takes place either in real time, through synchronous electronic chats where participants are typing at each other (Murphy & Collins, 1998), or as delayed asynchronous interaction, in which communication occurs at a participant's convenience.

Researchers have described a role change among distance education faculty from the instructor as a content expert to a facilitator of learning and an accompanying shift from teacher-centered to learner-centered instruction (Gunawardena, 1992). Providing learner-centered instruction requires the instructor to understand the distance learners. In such environments, instructors provide the overall structure: "Course design becomes more important, and preparation entails the structuring of conferences and topics, and the design of activities and small group work" (Romiszowski & Mason, 1996, p. 447).

Project-based learning activities have explicit educational goals and are typically learner-centered, rooted in constructivism, and facilitated by a teacher who acts as a facilitator. Fung (1996) identified ideal characteristics of learners involved in project-based activities as heightened levels of self-confidence, motivation, and the ability to organize work plans.

Based on these descriptions of project-based learning activities and characteristics of ideal characteristics of such learners, we asked the following questions about project-based learning on the Web:

1. What characteristics of project-based learning activities enable students to meet their learning objectives?
2. What strategies do student facilitators and student participants use to prepare and conduct project-based learning activities?

Methods

This study is a qualitative investigation of project-based learning activities in a Web-based course "Applications of Telecommunications in Education."

Course Overview.

The Web-based graduate course was designed to help learners apply telecommunications to specific educational contexts through independent and project-based activities in a constructivist learning environment. With the exception of a single class session for orientation and training near the beginning of the semester, students accessed course materials on the Web and used FirstClass™ computer conferencing software <http://www.softarc.com> for communication and to post coursework throughout the semester. The software provides multiple functions that foster collaboration: threaded discussions in icon-based conferences, collaborative document writing spaces, file attachments, private email, and real-time text-based chats. The students exchanged private and public messages in the threaded conferences, and they used the chat function to hold real-time scheduled and impromptu discussions with their project-based learning groups. They also used FirstClass to attach and download files and to work on collaborative documents. The text-based collaborative documents allow only one person to edit a document at a time, using different font types, colors, and sizes as in word processors. However, multiple readers could access these continuous unbroken documents simultaneously.

Students had two independent and two small group project-based learning requirements. Independent activities were to develop a Report for Action that would use telecommunications to solve an educational problem, and to maintain a Telecommunications Journal for students to keep track of their reflections on learning and teaching in an online environment. The two project-based learning activities, which took place in small groups of three to four students each, were to facilitate a unit activity and to develop a Web site. In addition, students completed several evaluations: a Pre-course Survey before the semester began; three collaborative anonymous ones during the semester (Orientation Evaluation, Formative Evaluation, and Final Thoughts); Private Group Evaluations following both of the project-based learning activities; and a private Course Evaluation at the end of the semester.

At the all-day session held on a Saturday three weeks after the beginning of the semester, the students met face-to-face for orientation and software training. The instructor had sent email before the semester to all of the students to inform them of access to the class Web site, and she asked them to download and install FirstClass client software on their own computers. This email message also directed the students to read FirstClass guidelines <http://fc.coe.tamu.edu> and to do the four online labs, with novice users paired with experienced users. As a result, the students used the Web tools for introductory assignments from the beginning of the semester. By the orientation session, they had already ranked their unit activity facilitation preferences and been assigned to their unit activity facilitating groups. At the orientation session, the students visited the university library to learn how to access and use electronic databases and other resources, and they sat down with their unit facilitating groups in the morning and with their Web site groups in the afternoon. In each of these group meetings, the members used a template

to develop a group learning contract for their activity (Murphy, Mahoney, & Harvell, 2000). The template included membership, communication, decision-making, emergencies, and changes. Once completed and posted on the Web, the contract was intended to be binding, though it could be changed by agreement of all group members. Either immediately or within a day or two, one member from each group posted the contract in the group's workspace in FirstClass.

This research focused on the project-based learning activities, which were based on the readings assigned for each unit. The five two-week unit activities were designated in advance: 1) discussions of learning in telecommunications environments; 2) role plays about teaching via telecommunications; 3) case studies about management via telecommunications; 4) evaluations of designated Web sites; and 5) panel discussions of three critical issues in telecommunications—plagiarism, ethics, and multiculturalism. The first three unit activities took place within two pre-assigned groups (A and B) of approximately nine students each, whereas the unit facilitators determined the organization of the two other activities. Brief descriptions of each unit activity follow.

Discussion (Learning) – This unit involved discussions focusing on different aspects of learning (e.g., self-directed learning, collaborative learning) and environments conducive to learning via telecommunications. The discussions took place as threaded discussions in the activity group workspaces A and B. The facilitators posted their initial questions to stimulate discussion, and as the participants replied, they followed up with other questions. The facilitators took pains to "weave" responses throughout the unit, and they synthesized the discussions at the end of the unit.

Role Play (Teaching) – The role play activity was designed for participants to play the roles of designers and instructors responsible for designing a mini-workshop. The facilitators chose the topic "Changing a Tire on a Motor Vehicle" and designed the role play activity for participants to adopt specific design team roles: editor, subject matter expert, instructional designer, instructional developer, graphic artist, programmer, and evaluator. This activity took place in two collaborative documents for the A and B groups. During the first week, the participants read the readings, signed up for their roles, and developed the outline of the workshop; in the second week they finalized the workshop.

Case Study (Management) – The instructor-developed case study called "Mythica" was a group problem-solving activity (Murphy, Moran, & Weems, 2000). Mythica is a mythical oil-producing country made up of 18 islands and inhabited by people accustomed to learning by rote memorization. The participants' challenge was to answer the seven questions related to the case study to propose a project for teaching English to the Mythicans. The facilitators' responsibilities included asking pointed questions, providing ancillary information, encouraging their teammates, and at the end, synthesizing the proposals. The facilitators presented the case and the seven questions to two teams (A and B) of their classmates, who each responded to a question in their collaborative documents. The team members helped their teammates with refinements of their replies.

Evaluation (Evaluation of Web Site) – The facilitators of the Evaluation unit designed the unit activity in the form of an evaluation of web-based materials in collaborative documents. During the first week of the activity, participants developed criteria for evaluating either a K-12

or a higher education web site under the guidance of their group facilitators. Facilitators compiled and revised the criteria at the end of the first week. During the second week, participants evaluated two web sites chosen by the facilitators, using the criteria they had developed collaboratively. At the end of the activity the participants revised the criteria. Facilitators summarized and synthesized the activity and suggested a final set of criteria for evaluating web-based materials.

Panel Discussion (Critical Issues) – This activity took place in collaborative documents as panel discussions of expert characters commenting on given scenarios about plagiarism, ethics, and multiculturalism in telecommunications. The participants joined two of the three panel discussions in the role of an expert character (e.g., university administrator, elementary school teacher, high school student, parent, CEO) by adding comments from their unique perspectives. In each collaborative document facilitators posted the scenario they wrote, expert character roles, and discussion questions for their critical issue. During the first week, to prepare for the panel discussions, participants read the selected articles and then decided on their two favorite issues. For each issue they were instructed to read the scenario and choose a role, considering how the expert character would respond to the scenario and recognizing the comments of others. Then the participants as expert characters added their own comments to the discussion. During the second week, the facilitators summarized comments made in each panel discussion and highlighted key points. The expert characters then clarified their positions and responded to points made by other characters.

Participants

Participants were the 17 students enrolled in the Web-based course in Fall semester 1999: 13 females and 4 males, and 10 master's and 7 doctoral students. The class included 9 students whose first language was English and 8 international students who spoke English as a second language. All students' previous experience with taking distance coursework was limited to two-way interactive videoconference enhanced by computer conferencing; none had previously taken a Web-based course.

Students-as-facilitators of the project-based activities were responsible for planning and carrying out the entire activity during the two-week unit. To prepare for co-facilitating the activities using FirstClass, each group of three to four facilitators met face-to-face during the initial orientation session to get to know one another and to develop their group learning contracts.

The facilitators were advised in the syllabus to plan their activities well in advance of their unit responsibilities. Each group of facilitators had a workspace, or computer conference, for planning purposes. Within their workspaces were two collaborative documents, for group learning contracts and for planning. In addition to communicating with their co-facilitators asynchronously in the group's conference, they usually communicated by real-time chat; they invited the instructor to at least one of the planning chats. At the beginning of their units, facilitators posted instructions to the participants about the activity. They also synthesized the work of their classmates during the last two days of the unit. After completing the activity, the co-facilitators evaluated their own and their group members' participation by completing a Private Group Evaluation form and sending it directly to the instructor.

Students-as-participants in the project-based unit activities were responsible for following the facilitators' specific instructions, which were posted at the beginning of the unit in the

specified unit conference. Participants first read the general instructions on the Web class page and then the specific instructions in FirstClass; they then read the required unit readings. Participants observed the timeline for posting their responses, signing up for roles and activities, and otherwise following the instructions of the facilitators during the two week units. Individual participation varied from 3 to 20 postings in each unit.

Data sources

The data sources were all online and included: (a) students' communication through FirstClass computer conference software; (b) interviews with the students via FirstClass; and (c) students' Course Evaluations at the end of the semester. Communication sources consisted of threaded computer conferencing messages and collaborative documents. The interviews that the second author conducted via FirstClass with the other students included open-ended questions about experiences as project group facilitators and participants.

Data Collection and Analysis

The investigation relied on case study methods, which are characterized by rich description of processes (Merriam, 1998). We downloaded the data sources, copied them into individual files for each data source, and printed them. We conducted content analyses (Emerson, Fretz, & Shaw, 1995) of the data sources by coding the data and categorizing them according to the research questions. We used colored markers to identify codes as we read the transcripts individually, and then we discussed the initial themes. We then converted the data to ASCII text and imported the data into QSR NUD*IST (Non-numerical Unstructured Data*Indexing Searching and Theorizing) qualitative data analysis software. For each major theme, we created "nodes" or categories (e.g., Facilitator Strategies), and for each node we created "child nodes" or sub-categories (e.g., Periodic Contact for Facilitator Strategies).

We reported on the data using the participants' words corrected only for comprehensibility. The following method identifies data quoted in the text: the data source and its specific location, the author of the message (if known), and the date. The data sources were: CC=Computer Conferencing Message, CD=Collaborative Document, CE=Course Evaluation, FE=Formative Evaluation, and IN=Interview. Computer conferencing messages were identified by the name of the conference in which they were posted, and collaborative documents were identified by their names. Each student was assigned a number, and data source identification is enclosed in brackets. For example, Student 11's Interview message on Dec. 8, 1999 would be identified as [IN-11-12/8/99]. Student 4's message on Oct. 13, 1999 in the computer conference called "Teach GpB discuss" would be identified as [CC, Teach GpB discuss-4-10/13/1999]. If a quoted entry was not dated, it is shown as n.d.

Results

The results of the two research questions are addressed in this section. The questions concern characteristics of project-based learning activities and strategies for conducting project-based learning activities in Web-based courses.

Question 1: What characteristics of project-based learning activities enable students to meet their learning objectives?

The intended learning outcomes for project-based learning activities were based on the learning objectives specified at the beginning of the course. The specific project-based learning objective for the facilitated unit activities was to "demonstrate proficiency in participating in and facilitating online activities and discussions." We identified three characteristics of project-based learning activities that produced positive learning outcomes in the Web-based course: (a) authentic activities; (b) collaborative work and communication via telecommunications; and (c) opportunities for knowledge enhancement and skill building.

The learning experiences were designed to be authentic, i.e., the students were to engage in real-life situations. The students perceived the unit group activities to be somewhat authentic. One student shared that, because "purpose was generated by the learner and acted upon ... in terms of learner arranged tasks, I believe it was authentic" [IN-12-12/9/99]. However, he qualified his observation: "to be truly authentic, the students would have had to recognize the problem" [IN-12-12/9/99], possibly based on the charge that the students had to select their topics from a list before understanding the assignment completely. Two students felt the course was strengthened by projects that were "meaningful" to them [CE-anon-12/99], and another student described the experience as both overwhelming and real: "I feel like I am having to go in too many directions at the same time. Not enough time to focus on one aspect and make it the best product before going on to the next. I realize though that this is similar to a real world setting" [FE-anon-10/99].

The project-based learning activities provided opportunities for the students to work in teams, an activity encountered frequently in real-life. By participating in these activities, the students learned to work collaboratively and communicate via telecommunications. To one student, the projects were "a means of learning how to cooperate and exchange ideas, knowledge, materials" [IN-8-03/01/00].

The activities fostered the enhancement of students' knowledge as well as the development of a variety of skills. Some students referred to their learning gains in terms of objectives, while others identified a variety of skills they gained. They referred to having built content knowledge and expertise: "at the end, I became an expert in that issue to some extent" [IN-8-03/01/00].

Question 2: What strategies do student facilitators and student participants use to prepare and conduct project-based learning activities in a Web-based course?

The students in the roles of both facilitators and participants in the project-based learning activities adopted a variety of strategies that helped them through the process. The students-as-facilitators were creative in preparing and conducting unit activities that would require active learning on the part of the participants. The students-as-participants paid close attention to the facilitators' instructions as they carried out the unit activities.

The students-as-facilitators faced the greatest challenge because they had to plan well ahead of the beginning of the two-week units. Their planning began with familiarizing themselves with the content and then preparing to guide the participants through the unit. Guided by their group learning contracts developed at the beginning of the semester, the unit facilitators' planning process took place via computer conferencing primarily through threaded discussions, collaborative documents, and chats. The facilitators figured out how to exploit the attributes of FirstClass to plan and conduct the activity for optimal learning potential and often even

requested additional workspaces such as collaborative documents for the participants to use during the activity. They developed communication conventions for effective use of collaborative documents: (a) using word-processing functions such as color-coding and font size, type, and style; (b) identifying their contributions by dating and signing their entries; and (c) when appropriate, placing the most recent entry at the top of the document.

In the planning phase the facilitators created timelines and assigned themselves tasks, and they established deadlines for the participants in the actual activity. They conducted live chats regularly to plan the unit activity, and they saved and posted these chats in their facilitator conference, their workspace designated for planning the unit activities. One facilitator was particularly sensitive to varying typing skills during chats and accommodated for slower typists by "wait[ing] for other group members who didn't type as fast ... or who needed more time to formulate a response" [IN-1-1/11/99]. They used collaborative documents to develop their plans and create outlines and documents, often taking care to be "very detailed in the writing of the procedures for the activity ... I was forced to look at every detail of the process ... from the perspective of the participants" [IN-5-12/12/99]. One group of facilitators neglected to adhere to the posted schedule and asked the participants to complete an activity prior to the typical Sunday deadline.

The facilitators were even busier as they conducted the activity. They used threaded discussions to post specific instructions to the participants about the activity. The instructions usually took the form of a single message in the group discussion conferences to welcome the participants, explain the process, describe the content, and provide resources. In the case of the Management unit, the facilitators posted two messages, one introducing the participants to the content and overall approach to be used for the unit and the second exclusively about the specific procedures for the participants to follow. In the final three units, facilitators designed their activities to take place in collaborative documents rather than in threaded discussions so that the participants could get a holistic view of the activity without having to open and close numerous messages.

During the unit, facilitators made revisions to the instructions and modifications to the activity itself, based on the feedback they received from participants. When two participants asked for clarification of the roles ID (Instructional Designer) and SME (Subject Matter Expert) that were posted in the instructions of the Teaching unit, a facilitator replied, "I added a reflection concerning ID and SME. What do you think?" [CC, Teach GpB discuss-13-11/10/1999]. A Learning unit facilitator modified the activity's requirements, explaining, "As I have seen, nobody has answered all three questions yet in our Group, thus, if you feel more comfortable with answering just two [questions], that will be OK for us. I think quality is much more important than quantity in this case" [CC, Learn GpA discuss-3-09/23/1999].

Facilitators also learned to adapt to each other's schedules and to emergencies. When one facilitator had to leave the country unexpectedly during the unit, the other facilitators covered her activities to the extent that the participants were totally unaware of her absence. Facilitators monitored activities by replying, weaving responses, and sending private email to individuals to encourage their participation by "more than just post[ing] a response" [IN-5-12/12/99]. They conducted live chats both during the activity, to monitor the progress of the groups, and after the unit activity, to synthesize the content and post it.

The students-as-participants used a variety of strategies to get through the unit. They followed the instructions of the facilitators and sought clarification when needed. "I need some help figuring out what I'm supposed to be doing. I have chosen the role of editor, but can't figure

out what I should do next. Please advise." [CC, Teach GpB discuss-10-10/9/99]. They logged in frequently to maintain the participant role. One participant explained, "I tried to check email frequently and respond immediately, whether I knew the answer to the question being asked or not - 'I'll get back to you' is better than not hearing from someone at all" [IN-1-1/11/00]. Several participants recognized the value of the expertise and knowledge of participants within their groups. One student asked for feedback on her input: "Group, please look at my objectives and if there are others that aren't coming to me right now, please add your thoughts. Thanks" [CD, Unit 3 Grp B colldoc-5-n.d.]. Another student asked the group to "think of possible sources of information where [they] could pull subject matter [CD, Unit 3 Grp B colldoc-13- n.d.]. One student complained about the changed schedule posted by the facilitators because she missed the deadline.

Many participants took care to use language and a writing style that was appropriate for their project-based work. "For example, instead of deleting material previously posted in a collaborative document even though it contradicted more current thinking, one student modified his original idea by adding and dating a new entry two days later directly after the first one. Otherwise, deleting the material would have confused those who had already read it. He wrote: "Following the visuals, learners will be prompted to name the steps in the correct sequence (10/15). Nope, I've changed my mind. Ultimate evaluation will be ... (10/17)" [CD, Unit 3 Grp B colldoc-9, 10/17/99]. Other participants used a conversational writing style to speak directly to fellow participants: "And yes, I agree, the focus on educating the user in the quickest and most effective way possible is critical." [CD, Unit 2 Grp B colldoc-9-n.d.]. Several of the American students reported making "a conscious effort to keep from regressing into Texas slang and colloquialism" [IN-12-9/12/99] for the sake of the many international students in the class.

Participants monitored their own project activity progress in several ways. They posted warnings: "I am worrying about the progress of our work" [CD, Unit 3 Grp A colldoc-3-10/15/99] and compared their own group with other activity groups: "I am really jealous of Group B's progress" [CD, Unit 3 Grp A colldoc-3-10/15/99]. One participant particularly skillful in using FirstClass foresaw a potential problem and took precautions to avoid it, explaining her actions: "I changed "D" to green because her color (orange) was too close to mine" [CD, Unit 2 Grp B colldoc-5-10/17/99].

Participants tended to be observant of others' differing levels of expertise and knowledge and often made allowances for them. One participant recognized the importance of giving "enough time to other participants for conducting learning" [IN-2-1/24/00]. Others offered encouragement and acknowledgment to their fellow participants during the activity: "Nice application of problem-based learning. Great reflection from the reading materials" [CD, Unit 3 Grp A colldoc-1-n.d.] and "Excellent start, T!" [CD, Unit 3 Grp A colldoc-6-n.d.]. Participants not only asked for clarification from other participants: "J, your interactive tutorial idea is ?... I'm a bit confused" [CD, Unit 2 Grp B colldoc-5-n.d.] but also gave positive feedback to others: "I really like your idea of a laptop or handheld computer program to be used as an electronic tutor to replace a paper manual for changing a tire" [CD, Unit 3 Grp B colldoc-9-n.d.].

Conclusions and Implications

This investigation sought to identify these aspects of project-based learning on the Web: (a) characteristics of activities that produce positive learning outcomes, and (b) student facilitator strategies, which were to prepare and conduct project-based learning activities; and student participant strategies, which were to learn the content that the facilitators presented. The five

activities of the graduate class were discussions, role-plays, case studies, evaluations, and panel discussions.

Notable characteristics of project-based learning activities were identified as environments that students perceived as authentic or meaningful, collaborative work and communication via telecommunications, and activities that provided students with opportunities for knowledge enhancement and skill building.

The strategies of the students-as-facilitators were related to planning and conducting the activity for the participants. The facilitators had to plan well ahead of the beginning of the unit, and they learned to exploit the attributes of FirstClass as they developed communication conventions to create timelines and assign themselves tasks to accomplish their plans. Acting in the role of an instructor facilitator (Berge, 1997) in conducting their project-based activities, the student facilitators posted specific instructions, made revisions to the instructions and modifications to the activity, monitored the progress of the activities, and adapted to each other's schedules.

The strategies of the students-as-participants were related to carrying out the activities specified by the facilitators. In following the facilitators' instructions, they sought clarification from the facilitators and from their fellow participants. Many participants took care to use language and a conversational writing style that was both appropriate for project-based work and considerate of the international students' limitations. Some of the participants monitored their own project activities–they posted warnings, compared their group with other activity groups, and took precautions to avoid potential problems. Participants tended to be observant of their fellow participants' differing levels of expertise and knowledge during the activity–they often made allowances by giving others enough time to reply and by offering them encouragement and acknowledgment.

Similar to research reported by Hill and Hannafin (1997), several graduate students in this study experienced learner disorientation, which inhibited their use of FirstClass and probably caused discomfort and confusion. This disorientation occurred for several reasons. Not only did the students facilitate and participate in the five project-based learning activities but they also developed Web sites in small groups. Many students complained about the requirement of two project-based learning activities in their Course Evaluations. Both of these complex collaborative activities required the students to develop and follow their group learning contracts so that they could assimilate and accommodate vast amounts of information in order to anchor and organize this information in relation to existing schemata and prior knowledge. Additionally, the two students who were enrolled in the instructor's two courses that semester expressed confusion because of the similar interfaces and types of assignments in the two courses. Several of the students may have experienced frustration similar to what students encountered in another Web-based class, in which the researchers concluded that the frustrations actually inhibited educational opportunities (Hara & Kling, 1999). Generally, however, the project-based learning activities in this study encouraged high quality work and stretching of capabilities in a supportive atmosphere, a finding consistent with research on distributed learning communities (Brown et al., 1993).

Increased use of Web for learning has created a developing body of literature on designing for online courses (Harasim et al., 1995; Khan, 1997). In this study, the instructor designed the online course to incorporate six design considerations for computer conferencing: two administrative design considerations, which were grading system and grouping; and four

instructional design considerations, which were collaboration, relevance, learner control, and technological preparation (Cifuentes et al., 1997).

The two administrative design considerations that Cifuentes et al. (1997) proposed were grading system and grouping. In this study, the grading was established so that 20 percent of the total grade was assigned to the unit activities—10 points for facilitating a unit and 2 points for each of the remaining five unit activities, which included orientation unit assignments. The unit activities themselves were so complex and time consuming that they have deserved more than 20 percent of the final grade. The second factor, grouping, is usually based on the size, location of the members, and composition of the groups. The instructor based her initial decisions about grouping on the number of students in the class (17) and the number of unit activity groups (5), thus determining that each group of facilitators would consist of 3 or 4 students. Additionally, because the students indicated their topic preferences, the instructor began by organizing the groups according to students' first choices. However, because the students had varied levels of telecommunications expertise and 8 of the students were international students, the instructor took into consideration the students' expertise with computer conferencing and their command of written English.

The four instructional design considerations—collaboration, relevance, learner control, and technological preparation—are described briefly and then applied to the course. Collaboration, or collaborative learning, was defined earlier as an instructional method in which small groups of learners work together to accomplish shared goals (Slavin, 1994). Each group of facilitators had to collaborate with each other via FirstClass to plan and conduct an activity for the participants over a two-week unit. Relevance, which is related to authentic and purposeful activities (Brown, Collins, & Duguid, 1989), was addressed through project-based work. The five unit activities—discussions, role plays, case studies, evaluations, and panel discussions—were representative of real world activities. According to Merrill (1983) and Reigeluth and Stein (1983), learner control is characterized by learners making choices in the pacing, sequence, and selection of instructional materials. The students-as-facilitators were in control of the pacing and sequence of their units, although the instructor had already selected the instructional materials. Each group's learning contract provided a structure for the facilitators to follow throughout the unit. Technological preparation is imperative for helping students become competent with the technology. To address "user-interface interaction" (Hillman, Willis, & Gunawardena, 1994), instructors should foster students' comfort with a new technology before they use the tools to deal with content. In this study, during the three weeks prior to the orientation and training session, the novice telecommunications users were paired up with experts to work through four FirstClass labs before they used the software for collaboration. By the end of the face-to-face session, all students were familiar enough with the software to begin their collaborative planning using FirstClass.

Suggestions for Future Research

Answers to the research questions should provide insight for course designers and instructors as well as students in Web-based courses. Knowing important characteristics of project-based learning activities will assist those who plan to incorporate such activities into the design of Web-based courses. The types of projects used in project-based learning may also make a difference in the quality of the product and the degree of student satisfaction. Future research could investigate the other project-based learning activity, the Web page development activity, and compare findings of this study to determine whether or not the characteristics of the

activities and the students' learning strategies were similar in the two activities. Such research would help us understand what learning strategies used by student facilitators and student participants are most and least productive with other types of project-based learning activities. Future research on project-based learning in Web-based courses could focus on other variables such as increased class size, graduate versus undergraduate classes, and classes that incorporate varying degrees of interaction.

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